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EXAMINER

GEBRESILASSIE, KIBROM K

ART UNIT

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2128

NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

gbpatent@gbpatent.com  
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<b>Office Action Summary</b>	<b>Application No.</b> 10/538,763	<b>Applicant(s)</b> SLONAKER, STEVEN DOUGLAS	
	<b>Examiner</b> KIBROM K. GEBRESILASSIE	<b>Art Unit</b> 2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 24 September 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-48 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 September 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>09/28/2005 &amp; 07/16/2008</u> .                             | 6) <input type="checkbox"/> Other: _____                          |

**DETAILED ACTION**

1. This communication is responsive to amended application filed on 09/24/2008.
2. Claims 1-48 are presented for examination.

***Response to Arguments***

3. Applicants' are thanked for amendment/Remarks.
4. Applicants' amendment relating to Drawing Objection is considered and is entered.
5. Applicants' response regarding IDS objection is persuasive and therefore the IDS filed on 09/28/2005 has been considered.
6. Applicants' argument/amendment relating to Claim Objection is persuasive and therefore the objection is withdrawn.
7. Applicants' argument relating to Specification Objection is persuasive and therefore the rejection is **withdrawn**.
8. Applicants' amendment/argument relating to 112 rejection is persuasive and therefore the rejection is **withdrawn**.
9. Applicants' amendment/argument relating to 101 rejection is considered.  
However, note new 101 rejection below.
10. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

***Claim Rejections - 35 USC § 101***

11. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. Claims 1-20 are rejected under 35 U.S.C. 101 as being directed to nonstatutory subject matter since the claims as a whole recites a calculation which appears to result in a mere manipulation of information and therefore would not provide for a practical application, as evidenced by lack of physical transformation or a useful, tangible, and concrete result.

For example, claims 1, 30, 42, 46, and 47 recite “characteristics data”, but the data is not specific data. The claim did not specify any particular type or nature of the data; nor did it specify how or from where the data was obtained or what the data represented. Therefore, Claims as a whole represent mere abstraction; i.e. a disembodied mathematical concept representing nothing more than an “abstract idea” which as a whole do not provide for a practical application.

13. As per claims 1, and 30, a valid process under 35 USC § 101 must either 1) transform underlying subject matter, or 2) be tied to another statutory class, such as a particular apparatus. In order to qualify as a statutory process, the claim should positively recite the other statutory class to which it is tied, for example by identifying the apparatus that accomplishes the method steps. A recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone (See In re Hirao, 535 F.2d

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67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1.951)).

***Claim Rejections - 35 USC § 102***

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

15. Claims 1-41 and 46-48 are rejected under 35 U.S.C. 102(a) as being anticipated by T. Nakashima, S. D. Slonaker, T. Kudo, and S. Hirukawa, "Evaluation of Zernike sensitivity method for CD distribution", Vol. 5040 (2003), 2003 SPIE (June 2003).

16. As per claim 1, Nakashima et al discloses a method of calculating estimated image profiles, comprising the steps of:

providing imaging configuration characteristic data (such as...*aerial image intensity...*; See: page 1603, "2.3 Surface Response of Aerial Image" paragraph one);

performing simulation calculations for various levels for each aberration components using the imaging configuration characteristic data (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph);

building response surface functional relations between variables of lens characteristics and an image profile of interest using the simulation calculations (such

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as...*calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size...*; See: page 1604, second and third paragraph and also equation 17); and

evaluating specified aberration values of a lens in relation to the response surface functional relations to provide an estimate of the image profile in a presence of specified aberration(s) (such as...*the aerial image intensity in addition to CD in this method quantifies the impact of not only the aberration and defocus but also the illumination uniformity in the slit, the brightness distribution at the illumination pupil...*; See: page 1604, paragraphs three and four).

17. As per claim 2, Nakashima et al discloses the method of claim 1, wherein the image profiles which result as part of the evaluating step are used as measures of relative lens adjustment goodness in an iterative lens adjustment optimization routine (such as...*the revised formula provides good correlation between approximated CD by this method and that calculated by the exact simulation...*; See: page 1603, lines 20-22).

18. As per claim 3, Nakashima et al discloses the method of claim 1, wherein the imaging configuration characteristic data includes lens data, illumination data and pattern data (See: Table 1).

19. As per claim 4, Nakashima et al discloses the method of claim 3, wherein: the illumination data includes at least one of illumination distribution and illumination wavelength, the lens data includes at least one of lens aberration, numerical aperture,

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pupil filters and lens configuration; and the pattern data includes object (reticle pattern) layout (See: Table 1 and 2).

20. As per claim 5, Nakashima et al discloses the method of claim 4, wherein the imaging configuration characteristic data further includes at least one of pattern bias characteristic information and lens focus (such as...*Fig. 2 shows the patterns, the illumination aperture shapes, and the correct CD-focus curves...*; See: page 1605, paragraph three).

21. As per claim 6, Nakashima et al discloses the method of claim 1, wherein the simulation calculations are executed for various levels of each aberration component (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph).

22. As per claim 7, Nakashima et al discloses the method of claim 1, further comprising the step of generating a new set of aberration component impact upon image profile fitted coefficients values using the response surface functional relations each time a new set of input aberration components is presented for image profile calculation (See: page 1604 lines 6-14, equation 17).

23. As per claim 8, Nakashima et al discloses the method of claim 1, further comprising the step of generating a new set of aberration components impact upon

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image profile coefficient values using interpolative methods using the response surface functional relations (See: page 1604 lines 6-14, equation 17).

24. As per claim 9, Nakashima et al discloses the method of claim 1, wherein the response surface functional relations correspond to a sample set of lens characteristics with a final output from application of response surface functional relations being an image profile under the influence of lens aberrations (See: page 1604 lines 6-14, equation 17).

25. As per claim 10, Nakashima et al discloses the method of claim 9, wherein the data configuration characteristic information includes lens characteristics related to variation in single aberration values alone or in combination with one another or with selected items from among the lens characteristics (See: Equation 14 and corresponding texts).

26. As per claim 11, Nakashima et al discloses the method of claim 1, wherein the response surface functional relations are related to a look-up table summarizing the results of interpolating the image profile generated by the simulation calculations of the performing step (such as...*to execute this method, we prepared lookup table of cross-terms of Z4 and the other aberration coefficients...*; See: page 1603, lines 20-22).

27. As per claim 12, Nakashima et al discloses the method of claim 11, wherein the look-up table is direct simulation image profile results or of functional coefficients used to calculate the image profile (such as...*to execute this method, we prepared lookup table of cross-terms of Z4 and the other aberration coefficients...the revised formula*



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*provides good correlation between the approximated CD by this method and that calculated by the exact simulations...; See: page 1603, lines 20-22).*

28. As per claim 13, Nakashima et al discloses the method of claim 11, wherein the evaluating step includes determining image profile data points using the look-up table to provide a new image profile associated with specified aberration values (such as...*to execute this method, we prepared lookup table of cross-terms of Z4 and the other aberration coefficients...the revised formula provides good correlation between the approximated CD by this method and that calculated by the exact simulations...; See: page 1603, lines 20-22).*

29. As per claim 14, Nakashima et al discloses the method of claim 1, wherein the evaluating step includes applying interpolated data of the built response surface functional relations to calculate the image profile for specified aberration values (See: Equations 16 and 17).

30. As per claim 15, Nakashima et al discloses the method of claim 1, wherein the evaluating step eliminates the need for a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile (such as...*although the above explanation requires calculation of the coefficient sets for all simulation pixels, only the coefficients near the slicelevel will be used. This allows reduction of the actual calculation volume...; See: page 1604, paragraph three).*

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31. As per claim 16, Nakashima et al discloses the method of claim 1, wherein the building steps includes providing a fitting function expressed as:

$$I_{spx}(x) = b_0 + b_1x + b_2x^2 + b_3x^3 + \dots + b_nx^n$$

where  $I_{spx}$  is aerial image intensity or amplitude at a simulation pixel ( $spx$ ) and  $x$  indicates defocus; and

expressing a change of the coefficients  $b_0 \dots b_n$  described by an order fitting function expressed as:

$$\begin{aligned} b_{i(\text{with aberration})} &= b_{i(\text{w/o aberration})} + \sum_{j=2}^{2n} \Delta b_i(c_j) \\ &= b_{i(\text{w/o aberration})} + \sum_{j=2}^{2n} \varphi_{0(i,j)} + \varphi_{1(i,j)}c_j + \varphi_{2(i,j)}c_j^2 + \varphi_{3(i,j)}c_j^3 + \dots + \varphi_{n(i,j)}c_j^n \end{aligned}$$

wherein

$$i = 0, 1, 2, 3, \dots, n;$$

$b_{i(\text{with aberration})}$  and  $b_{i(\text{w/o aberration})}$  represents one of the coefficients  $b_0 \dots b_n$  influenced by lens aberrations and the coefficients  $b_0 \dots b_n$  without aberrations, respectively, and

$\Delta b_i$  indicates the change in coefficients and is expressed by an  $n^{\text{th}}$  order fitting function of  $j$ th Zernike coefficient  $c_j$ .

$\varphi_{0(i,j)}, \dots, \varphi_{n(i,j)}$  are the coefficients of the fitting function, determined following the performing step of setup simulations of image profile as a function of regularly iterated values of lens aberration.

(See: Equations 16

and 17).

32. As per claim 17, Nakashima et al discloses the method of claim 16, wherein the

fit coefficients  $\varphi_{0(i,j)}, \dots, \varphi_{n(i,j)}$  are generated from a single aberration

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polynomial coefficient or from at least one of multiplication division of one aberration polynomial coefficient by another (See: page 1604, paragraph three, also equation 17).

33. As per claim 18, Nakashima et al discloses the method of claim 16, wherein the coefficients  $b_0 \dots b_n$  are stored for each simulation calculation following their determination via fitting to the simulation calculation of the performing step (such as...*the coefficient  $b_0 \dots b_n$  are stored for each simulation pixel*...See: pg. 1603 last paragraph).

34. As per claim 19, Nakashima et al discloses the method of claim 16, wherein  $n=4$  (such as *fourth order fitting function*).

35. As per claim 20, Nakashima et al discloses the method of claim 16, wherein  $Z_n=37$  (See: equation 17).

36. As per claim 21, Nakashima et al discloses the method of claim 1, wherein each different aberration value applied during the performing step leads to one full image simulation calculation (such as...*calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size*...; See: page 1604, second and third paragraph and also equation 17).

37. As per claim 22, Nakashima et al discloses the method of claim 1, wherein the evaluating step provides one output image profile for each one set of specified input aberration values (See: Figs. 3-5).

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38. As per claim 23, Nakashima et al discloses the method of claim 1, wherein the response surface function relations are built relating any of variables: (i) position within a specified image plane, (ii) intensity or amplitude, (iii) focus, and (iv) all component aberration levels (See: page 1605, first paragraph).

39. As per claim 24, Nakashima et al discloses the method of claim 1, wherein the performing step includes the steps of: defining a simulation pixel as a unit of horizontal or vertical, position into which an aerial image is divided; calculating aerial image amplitude or intensity on each simulation pixel; and executing the calculations at defocus positions to provide image profile data including focus response (See: "2.3 Surface Response of Aerial Image").

40. As per claim 25, Nakashima et al discloses the method of claim 1, wherein the evaluating step includes summing an impact from all specified aberration values or combinations of values defined as aberration coefficients for image profile reconstruction (See: page 1603, "2.3 Surface Response of Aerial Image", paragraph two).

41. As per claim 26, Nakashima et al discloses the method of claim 25, wherein the summing step provides an output of intensity or amplitude vs. at least one of position and focus for the specified aberration values which are an arbitrary set of aberration values (See: page 1603, "2.3 Surface Response of Aerial Image", paragraph two).

42. As per claim 27, Nakashima et al discloses the method of claim 1, wherein the evaluating step is performed using a linear equation using fixed functions with

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coefficients determined in the building step (See: equations 16, 17 and corresponding texts).

43. As per claim 28, Nakashima et al discloses the method of claim 1, wherein the building and evaluating steps are performed using a sinusoidal fitting functions (such as...*fitting function may provide more accurate results, and other methods of fitting response to focus and aberration, for example involving sinusoidal function..*; See: page 1604, paragraph one).

44. As per Claim 29, Nakashima et al discloses the method of claim 28, wherein the sinusoidal fitting functions are encountered when applying a Fourier Transformation or Fast Fourier Transform algorithm intended to estimate a Fourier Transformation process (such as...*fitting function may provide more accurate results, and other methods of fitting response to focus and aberration, for example involving sinusoidal function..*; See: page 1604, paragraph one; Equation 17).

45. As per claim 30, Nakashima et al discloses a method of calculating estimated image profiles, comprising the steps of:

performing simulation calculations for various levels of aberration components using image configuration characteristic data (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph);

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building response surface functional relations between variables of the image configuration characteristics and the image profile of interest using the simulation calculations data (such as... *calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size...*; See: page 1604, second and third paragraph and also equations 16 and 17) input to be fit using:

$$I_{spx}(x) = b_0 + b_1x + b_2x^2 + b_3x^3 + \dots + b_nx^n$$

where  $I_{spx}$  is aerial image intensity or amplitude at a simulation pixel ( $spx$ ) and  $x$  indicates defocus; and

expressing a change of the coefficients  $b_0 \dots b_n$  described by an order fitting function expressed as:

$$\begin{aligned} b_{i(\text{with aberration})} &= b_{i(\text{w/o aberration})} + \sum_{j=2}^{2n} \Delta b_i(c_j) \\ &= b_{i(\text{w/o aberration})} + \sum_{j=2}^{2n} \varphi_{0(i,j)} + \varphi_{1(i,j)}c_j + \varphi_{2(i,j)}c_j^2 + \varphi_{3(i,j)}c_j^3 + \dots + \varphi_{n(i,j)}c_j^n \end{aligned}$$

wherein

$$i = 0, 1, 2, 3, \dots, n;$$

$b_{i(\text{with aberration})}$  and  $b_{i(\text{w/o aberration})}$  represents one of the coefficients  $b_0 \dots b_n$  influenced by lens aberrations and the coefficients  $b_0 \dots b_n$  without aberrations, respectively, and

$\Delta b_i$  indicates the change in coefficients and is expressed by an  $n^{\text{th}}$  order fitting function of  $j$ th Zernike coefficient  $c_j$ .

$\varphi_{0(i,j)}, \dots, \varphi_{n(i,j)}$  are the coefficients of the fitting function, determined following the performing step of setup simulations of image profile as a function of regularly iterated values of lens aberration.

(See: Equations 16,

17 and corresponding texts)

summing an impact from at least one of all new specified aberration coefficients and combinations of aberration coefficients from the built response surface functional relations to provide lens adjustment data (See: equation 17 and corresponding texts).

46. As per Claim 31, Nakashima et al discloses the method of claim 30, wherein the imaging configuration includes lens data, illumination data and pattern data (See: Table 1).

47. As per Claim 32, Nakashima et al discloses the method of claim 30, wherein: the illumination data includes at least one of illumination distribution and illumination wavelength; the lens data includes at least one of lens aberration, numerical aperture, pupil filters and lens configuration; and the pattern data includes object (reticle pattern) layout (See: Table 1 and 2).

48. As per Claim 33, Nakashima et al discloses the method of claim 30, wherein the simulation calculations are provided for various levels of each aberration coefficient (such as...*calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size...*; See: page 1604, second and third paragraph and also equation 17).

49. As per Claim 34, Nakashima et al discloses the method of claim 30, further comprising the step of generating a new set of aberration component values using the response surface functional relations each time a new lens adjustment is considered (See: page 1604 lines 6-14, equation 17).

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50. As per Claim 35, Nakashima et al discloses the method of claim 30, wherein the summing step includes interpolating data points of data calculated by the simulation calculations to provide a new image profile associated with the new specified aberration coefficients (See: page 1604 lines 6-14, equation 17).

51. As per Claim 36, Nakashima et al discloses the method of claim 30, wherein the coefficients  $b_0 \dots b_n$  are stored for each simulation calculation (such as...*the coefficient  $b_0 \dots b_n$  are stored for each simulation pixel*...See: pg. 1603 last paragraph).

52. As per Claim 37, Nakashima et al discloses the method of claim 30, further comprising the steps of: defining a simulation pixel as a unit of horizontal or vertical position into which aerial image is divided; calculating aerial image intensity or amplitude for each simulation pixel; and executing the image simulation calculations at defocus positions to provide image profile response to focus data (See: "2.3 Surface Response of Aerial Image").

53. As per Claim 38, Nakashima et al discloses the method of claim 30, wherein the response surface function relations are built between any of variables: (i) position, (ii) intensity or amplitude, (iii) focus, and (iv) all component aberration levels (See: page 1605, first paragraph).

54. As per Claim 39, Nakashima et al discloses the method of claim 30, wherein the summing step provides an output of intensity or amplitude vs. at least one of position and focus for any arbitrary set of aberration values (See: page 1603, "2.3 Surface Response of Aerial Image", paragraph two).



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55. As per Claim 40, Nakashima et al discloses the method of claim 30, wherein  $n=4$  (such as *fourth order fitting function*).

56. As per Claim 41, Nakashima et al discloses the method of claim 30, wherein  $Z_n=37$  (See: equation 17).

57. As per claim 46, Nakashima et al discloses a system for providing optimal image profiles through the optimization of specified aberration components, according to their associated impact upon image profile, comprising:

means for performing simulation calculations for various levels of aberration components using characteristic data; means for building response surface functional relations between variables of lens characteristics using the simulation calculations (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph);

means for evaluating specified aberration values of a lens in relation to the response surface functional relations to provide image profile estimates for the specified aberration values (such as...*the aerial image intensity in addition to CD in this method quantifies the impact of not only the aberration and defocus but also the illumination uniformity in the slit, the brightness distribution at the illumination pupil...*; See: page 1604, paragraphs three and four); and

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means for applying the aberrated image profile estimates in an optimization calculation method which judges image profile information against defined criteria as part of a lens adjustment optimization calculation (See: Table 1 and Table 2).

58. As per claim 47, Nakashima et al discloses a tangibly-embodied machine readable medium containing code operable to adjust for adjusting a lens, comprising at least one module for:

performing simulation calculations for various levels for each of aberration components using characteristic data (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph);

building response surface functional relations between variables of lens characteristics using the simulation calculations (such as...*calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size...*; See: page 1604, second and third paragraph and also equation 17); and

evaluating specified aberration values of a lens in relation to the response surface functional relations to provide image profile estimates for the specified aberration values (such as...*the aerial image intensity in addition to CD in this method quantifies the impact of not only the aberration and defocus but also the illumination uniformity in the slit, the brightness distribution at the illumination pupil...*; See: page 1604, paragraphs three and four).

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59. As per claim 48, Nakashima et al discloses the machine readable code of claim 47, wherein the at least one module applies the aberrated image profile estimates in an optimization calculation method which judges image profile information against defined criteria as part of a lens adjustment optimization calculation (such as...*the revised formula provides good correlation between approximated CD by this method and that calculated by the exact simulation...*; See: page 1603, lines 20-22).

***Claim Rejections - 35 USC § 103***

60. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

61. Claims 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over T. Nakashima, S. D. Slonaker, T. Kudo, and S. Hirukawa, "Evaluation of Zernike sensitivity method for CD distribution", Vol. 5040 (2003), 2003 SPIE (June 2003) in view of US Patent No. 5, 623, 853 issued to Novak et al.

62. As per claim 42, Nakashima et al discloses an exposure apparatus, comprising:

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an illumination system that projects radiant energy through a mask pattern on a reticle R that is supported by and scanned using a wafer positioning stage (such as...*exposure tool projection lens*...; See: "1. Introduction" line 1);

a system for providing optimal image profiling (See: "1. Introduction" paragraph two), including:

means for providing image configuration characteristic data (such as...*aerial image intensity*...; See: page 1603, "2.3 Surface Response of Aerial Image" paragraph one);

means for performing simulation calculations for various levels of aberration components using the image configuration characteristic data (such as....*a CD is automatically calculated from the aerial image intensity around the slicelevel positions....calculated aerial image intensity for each simulation pixel...fitting function are applied....*; See: "2.3 Surface Response of Aerial Image" first and second paragraph);

means for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations (such as...*calculated aerial image intensity on each simulation pixel with each coefficient of 36 Zernike terms and 11 steps of the coefficient size...*; See: page 1604, second and third paragraph and also equation 17); and

means for evaluating specified aberration values of a lens in relation to the response surface functional relations to provide image profile estimates for the specified aberration values (such as...*the aerial image intensity in addition to CD in this method*

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*quantifies the impact of not only the aberration and defocus but also the illumination uniformity in the slit, the brightness distribution at the illumination pupil...; See: page 1604, paragraphs three and four).*

63. As per claim 43, Nakashima et al discloses the apparatus of claim 42, further comprising means for applying the aberrated image profile estimates in an optimization calculation method which judges image profile information against defined criteria as part of a lens adjustment optimization calculation (such as...*the revised formula provides good correlation between approximated CD by this method and that calculated by the exact simulation...*; See: page 1603, lines 20-22).

Nakashima et al fails expressly to disclose at least one linear motor that positions the wafer positioning stage.

Novak et al discloses at least one linear motor that positions the wafer positioning stage (See: Col. 2 lines 14-16).

It would have been obvious to one of ordinary skill in the art to combine the teachings of Novak et al with the teachings of Nakashima et al because both reference concerned with lithography system. The motivation to do so would be to align a wafer in a lithography system having extreme precision and to ensure a smooth relative motion of the wafer stage in the X/Y direction.

64. As per claim 44, Novak et al discloses a device manufactured with the exposure apparatus of claim 42 (such as...*The XY stage depicted herein is for lithography on semiconductor wafers...*; See: Col. 6 lines 40-41).

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65. As per claim 45, Novak et al discloses a wafer on which an image has been formed by the exposure apparatus of claim 42 (such as ...*An XY stage for precision movement for use in aligning a wafer in a microlithography system* . . . ; See: Col. 1 lines 7-9).

### **Conclusion**

66. All claims are rejected.

67. **Examiner Remarks:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant.

**Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well.** It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

68. **Examiner Request:** In the case of amending the claimed invention, **Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on** for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

### **MPEP states:**

"...with respect to newly added or amended claims, applicant should show support in the original disclosure for the new or amended claims. See MPEP § 714.02 and § 2163.06."

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69. **Requests for Interview:** In accordance with 37 CFR 1.133(a)(3), requests for interview must be made in advance. Interview requests are to be made by telephone (571-272-8571) or FAX (571-273-8571). Applicants must provide a detailed agenda as to what will be discussed (generic statement such as "discuss §102 rejection" or "discuss rejections of claims 1-3" may be denied interview). The detail agenda along with any proposed amendments is to be written on a PTOL-413A or a custom form and should be faxed (or emailed, subject to MPEP 713.01.I / MPEP 502.03) to the Examiner at least 3 days prior to the scheduled interview. Interview requests submitted within amendments may be denied because the Examiner was not notified, in advance, of the Applicant Initiated Interview Request and due to time constraints may not be able to review the interview request to prior to the mailing of the next Office Action.

70. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KIBROM K. GEBRESILASSIE whose telephone number is (571)272-8571. The examiner can normally be reached on 8:00 am - 4:30 pm Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on 571-272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

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For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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